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ABSTRACT

A study investigated the self-perceived, on-the-job literacy tasks of electrical mechanic apprentices in Victoria, Australia. A random sample of 401 apprentices from 19 locations representing all levels of apprenticeship training were questioned about their reading needs and the consequences of making a reading error in their work. Data were processed and analyzed using the Lotus 1-2-3 IBM computer program. The apprentices stated that they were mainly involved with reading nonprose materials, especially warnings, electrical wiring/circuit diagrams, and job sheets for their on-the-job needs. The consequences of making a reading error that was work-related were felt to involve mainly wasting time and materials, having to redo the job, and inconveniencing people. Results indicated that apprentice training institutions should give greater emphasis to the development of skimming and scanning skills in reading as well as extended practice in processing and understanding a variety of graphical materials that apprentices encounter in their work. (YLB)

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NEW DIRECTIONS IN APPRENTICE SELECTION:

SELF-PERCEIVED "ON THE JOB" LITERACY (READING) DEMANDS OF APPRENTICES

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Abstract

The study was designed to investigate the self-perceived, on-the-job literacy tasks of electrical mechanic apprentices in Victoria, Australia. A random sample of 401 apprentices from 19 locations representing all levels of apprenticeship training were questioned about their reading needs and the consequences of them making a reading error in their work. The data was then processed and analysed using the Lotus 123 IBM computer program. The apprentices stated that they were mainly involved with reading non-prose materials, especially warnings, electrical wiring/circuit diagrams and job sheets for their on-the-job needs. The consequences of making a reading error which was work-related was felt to involve mainly the wastage of time and materials, having to redo the job and inconveniencing people. According to the results, it would appear that apprentice training institutions should give greater emphasis to the development of skimming and scanning skills in reading as well as extended practice in processing and understanding a variety of graphical materials which apprentices encounter in their work.

Background

In recent years there has been growing concern in both the public and private sectors of the industrial workforce over the selection procedures of apprentices. The concern has been generated in part by the very high exit rate of apprentices and young tradespeople from the industry which has been estimated as between 40-60% (Taylor, 1987).

In particular, the use of literacy tests and more specifically reading tests used in the recruiting process, has come under scrutiny. One of the main problems with these types of tests is their inability to predict which prospective apprentices will be able to cope with the variety of reading task associated with a specific trade.

> . . . studies have shown that the predictive ability of the tests to select 'good' apprentices and 'weak' apprentices is not sound. Often candidates score high on the screening test but perform poorly in the trade, while some of the lowest scoring candidates prove to be very good apprentices.
>
> (Edwards and Gould, 1987, p.11)

Any attempt to discuss literacy skills tends to encounter the problem of defining just what is meant by "literacy". Sofo (1984) pointed out that "it is widely recognized that while definitions of literacy abound, none is completely successful in delineating the concept" (p.39). Sticht et al. (1970) had earlier suggested that "literacy" referred usually to "reading", although reading itself consisted of a complex of language skills based on both listening and speaking. Stedman and Kaestle (1987) attempted to solve this problem by

comparing the literacy skills taught in schools, usually known as "reading achievement" with the "functional literacy" skills used outside of schools. The authors proposed a model of literacy consisting of two dimensions.

> We treat the acquisition of initial literacy and subsequent grade-level achievement - the focus of the school - as the 'vertical' dimension, and we treat the measurement of diverse reading tasks from everyday life - functional literacy - as the 'horizontal' dimension. (p.11)

It is the contention of this paper that the "vertical" model of literacy which places most emphasis on traditional reading skills as a predictor of academic achievement, has been used misguidedly to predict on-the-job reading skills in the past and there is now an urgent need to make much more use of the "horizontal" model of literacy when researching the literacy needs of apprentices.

The traditional use of standardized reading tests had been to assess an individual's vocabulary, comprehension and reading rate, using materials selected from a wide variety of subject matter content, including the natural and social sciences, fiction and human interest stories.

The comprehension score which forms the main bulk of the total reading score is derived by asking the reader questions which require an understanding of the stated content, a perception of important details, or the ability to draw reasonable inferences.

However, the use of traditional reading tests to screen prospective apprentices would appear to be completely inappropriate. It was reported in an earlier paper (Edwards and Gould, 1987) that:

> The reading tasks of apprentices on the job . . . bear little resemblance to those of students studying academic subjects in a traditional school setting. Research into the reading needs of apprentices illustrates a wide range of skills and materials that places more emphasis on skimming and scanning . . . rather than a lengthy, scholarly treatment of passages of prose. (p.11)

The writers pointed out that although they were not advocating that apprentices should not be taught general reading skills, they were suggesting that a completely different emphasis should be given to reading tasks in trade related courses (Edwards and Gould, 1987). They suggested that new directions in apprentices' reading training should include working with a wide range of materials including:

job sheets
maintenance charts
roster boards
video display units
trade manuals
manufacturer's instructions
builder's specifications and plans
rules and regulations
charts of tool sizes
microfiche for ordering parts (p.11)

Along with the need to review and revise the curricula for apprenticeship training is the vitally important need for more relevant assessment instruments in the selection of prospective apprentices.

Feletti (1984) explained this need succinctly in describing an approach to improve assessment as an educational experience. He stressed that it was important to "review what is to be assessed, by what kind of instruments, and the manner in which the assessment is conducted" (p.295). Feletti (1981) outlined a number of steps to follow in improving the validity of the test situation. The first three steps are relevant to this discussion and are as follows:

1. Develop formative tests to help students practise and consolidate their learning, and to recognize the level of competence needed. Provide remedial advice on strengths and weaknesses in performance, but do not consider these data when deciding academic results.

2. Develop summative assessment instruments which focus more on integration and application of learning than factual recall *per se*, and their understanding of basic mechanisms underlying the problem which students are attempting to solve.

> 3. Measure performance against criteria for competence, which are determined before the assessment occurs and which represent the objectives for students' achievement. Integrate the assessment of these objectives with those from earlier coursework where appropriate. (p.295)

A number of studies in recent years has examined the practice of using traditional, standardized reading tests as predictive instruments for apprentices' performance. Learmont (1978) conducted a study into the reading skills and various background factors of forty-six, first year plumbing apprentices. The Gapadol Reading Comprehension Test was used in this study and the results were correlated with socio-economic and educational factors.

Learmont noted that there was "concern regarding the suitability of the Gapadol Test for apprentice groups" (p.1) but added that there was little choice in this regard. Among her recommendations, Learmont included:

> Work should be undertaken to develop a standardised reading test which is specifically geared for apprentices;
>
> and
>
> More specific research should be done concerning the importance of literacy skills to the performance of students during their apprenticeship training program. (p.13)

Another study by Learmont (1979) of 147 first year apprentices from four trade areas (Building Construction, Electrical, Machines and Materials, Plumbing and Mechanical Services) was undertaken to investigate the relationships between their socio-economic status and their reading abilities.

Among the recommendations made was the following:

> A more reliable basis to determine an accurate selection of apprentices with poor reading abilities; maybe the use of reading tests designed specifically for each trade. Vocational referenced tests may be a more accurate indication of an apprentice's ability to read the trade-oriented information which forms an integral part of the training program. (p.114)

During 1980, an extensive survey of the literacy and numeracy demand made on first year apprentices in Queensland was conducted by Morris and Cope (1982). The study involved ten trades and some 70 per cent of all first year apprentices in the state. The researchers found that "in almost all trades, workers must understand graphical material" and that "reading which does occur on the job is usually done to accomplish something" (p.43). Morris and Cope (1982) made a number of recommendations concerning reading skills which they felt would improve the situation, including:

> That school curricula be related to the literacy . . . demands made on all school leavers . . . .
> That school place emphasis on reading-to-do as well as on reading-to-learn tasks.
> That schools emphasize the development of reading skills in all subject areas.
> That schools place emphasis on developing graphical literacy skills. (p.5)

In 1982, Sticht presented the results of a major research study into the basic skills programs of the U.S. military forces. The revised Armed Forces Qualification Test (AFQT) which consisted of Reading (Vocabulary and Paragraph Comprehension) and Mathematics (Basic Computation and Arithmetic Reasoning) was used in the study. Among the findings, it was found that:

> Attrition is highest for those lowest in basic skills and is more highly related to the demands for basic skills use during "academic" as contrasted with "performance" phases of training. (p.vi)

However, Sticht also commented on the fact that many of the less literate personnel performed as well as the more literate and suggested that, "screening instruments are not accurate enough to distinguish the potentially adequate from the inadequate" (p.v).

Sofo (1984) investigated the literacy skills of 194, level one and level two automotive mechanic apprentices enrolled in a Victorian TAFE college. Sofo used specially developed vocational literacy tests

(VORELATE), for he found that no suitable literacy tests were available. The VORELATE tests were designed to measure and compare the auding and reading skills of the apprentices in relation to their job training materials and their progress through the course.

Sofo found that the VORELATE tests could be used to identify "at risk" automotive mechanic apprentices but because of the content specific nature of the tests,

> detailed analyses should be conducted in relation to the skills requirements of the learning tasks in various training modules in the print, audio and audio-visual and computer formats. (p.270)

Gould (1986) tested fifty, third year electrical mechanic apprentices from the Royal Melbourne Institute of Technology (RMIT) to determine whether their reading ability could help to predict their performance on the State Electricity Commission's B grade theory licensing examination.

The Nelson Denny Reading Test, which is a widely used standardized instrument, was used to obtain scores in vocabulary, comprehension and reading rate. When these results were correlated with the State Electricity exam marks, no relationship was found to exist. A further analysis which divided the apprentices into high, medium, and low reading ability groups, provided the same result.

Gould (1986) concluded that because no relationship was found between reading ability and exam scores, the use of traditional, standardized reading tests such as the Nelson Denny would appear to be inappropriate as selection instruments for prospective electrical mechanic apprentices. Gould suggested that research should be conducted to determine which factors were important in a student's success, and that from this research suitable tests for apprentices should be developed.

The concern expressed by the researchers previewed about the need for new literacy assessment procedures for "non academic interests" led to the present study. Because of the magnitude of the task, it was decided to initially conduct a pilot study to determine the literacy and numeracy needs of apprentices. It is the results of the reading component of the literacy section that are presented in this paper.

Research Questions

The resolve to investigate apprentices' self-perceived on-the-job needs in literacy and numeracy raised a number of questions that remain to be analysed. For the purposes of this paper which examined the literacy (reading) needs of electrical mechanic apprentices, the following research questions were posed.

1. What are the types of reading tasks that electrical mechanic apprentices perceive themselves doing on-the job?
2. What do the electrical mechanic apprentices think would be the consequences of them not understanding an on-the-job reading task?

Method

Subjects

Participants in the study were four hundred and one electrical mechanic apprentices in the first, second, third and fourth (repeat) years of their apprenticeship. The sample, which included one female, was taken from a wide range of metropolitan and country training centres in Victoria, Australia (see **Figure 1**).

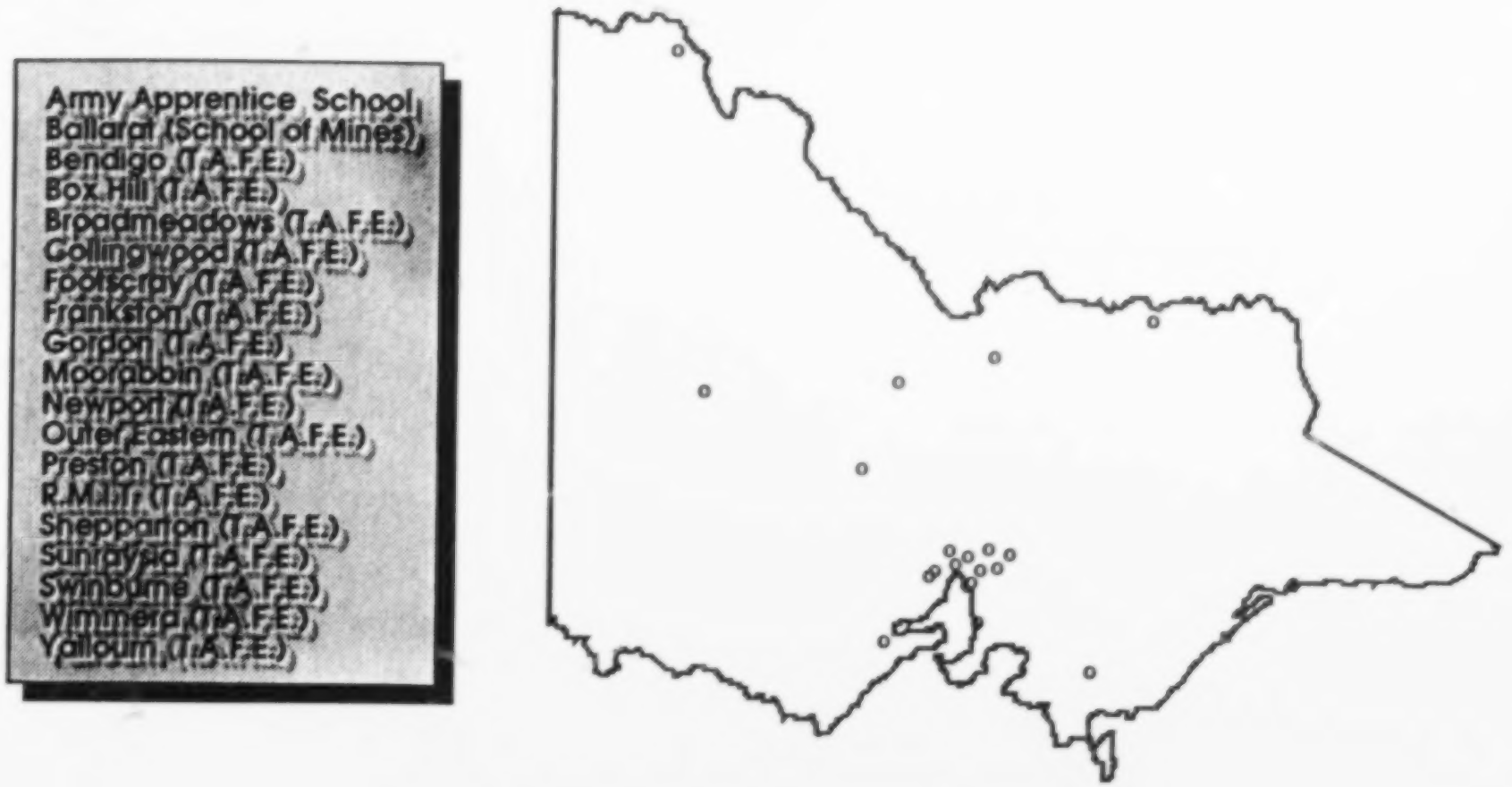

Figure 1 **Location of Training Centres in Victoria**

The majority of the apprentices had left school at the completion of Year 11 although some had left as early as Year 9 and a few in the metropolitan area had completed Year 14. The main language spoken at home was English (370), seven apprentices were from bi-lingual families, there was one Aboriginal apprentice from the country and apart from two Chinese apprentices the remainder were from European or Middle Eastern backgrounds.

The subjects used in the study were randomly selected from the total pool of apprentices across Victoria and the sample was a 20 per cent or higher representation from each of the training centres (see **Table 1).**

Table 1. Numbers and Percentages of the Total Sample of Apprentices Mechanic Apprentices

	Sample	Total	% of Total
Army Apprentice School	2	7	29
Ballarat School of Mines	7	32	22
Bendigo TAFE	24	24	100
Box Hill TAFE	42	207	20
Broadmeadows TAFE	17	81	21
Collingwood TAFE	20	98	20
Footscray TAFE	27	134	20
Frankston TAFE	21	101	21
Gordon Technical College	28	140	20
Moorabbin TAFE	22	106	21
Newport TAFE	20	43	47
Outer Eastern TAFE	22	72	31
Preston TAFE	36	178	20
RMIT Technical College	39	195	20
Shepparton TAFE	22	36	61
Sunrasia TAFE	16	16	100
Swinburne TAFE	10	46	22
Wimmera TAFE	10	10	100
Yallourn TAFE	16	77	21
	401	1603	25

Overall there was approximately an 80 per cent return of questionnaires which represented a 21 per cent return from the metropolitan centres and a 36 per cent from the country. The numbers of apprentices in each year level was as follows: FIRST YEAR, 146; SECOND YEAR, 125; THIRD YEAR, 111; and FOURTH YEAR (REPEAT), 16. Three of the apprentices did not state their year level on the questionnaire.

Materials

The apprentices completed a group-administered questionnaire which contained twenty-seven items concerning the types of reading tasks, frequency of use of reading materials, and the consequences of making a reading error on-the-job. Some of the questionnaire items were based on studies by Sticht (1982), while the remainder were developed in consultation with trade teachers and other professionals associated with apprentice training.

Procedure

A letter explaining the nature and purpose of the study was sent to the person in charge at each of the training institutions. A sample of the questionnaire was included, information on the number of apprentices was asked and permission was sought to conduct the survey during the months of September to November. These were considered to be the best months as all of the apprentices would be attending trade school at least once during this period.

Most of the persons in charge replied very promptly and were then sent the required number of questionnaires along with a brief set of instructions for the instructors who would be administering the survey. Arrangements were also made with each training centre to either have the completed questionnaires collected or returned by post.

Overall there was a 80% return of questionnaires which was greatly appreciated by the researchers.

The response sections of the questionnaire had been coded to facilitate ease of operation and also to enable distinctions to be made between the important variables in the study. When the completed questionnaires were assembled, the selected samples were prepared for computer processing.

Results

The IBM, Lotus 123 computer program utilising the data base component was used to analyze the apprentices' responses to the questionnaire. The first research question posed in the study was:

> What are the types and the frequency of reading tasks that electrical mechanic apprentices perceive themselves doing on-the-job?

The apprentices were allowed to give multiple responses to this part of the questionnaire, and their total responses to the specific reading skills are presented in **Table 2.**

Table 2

Frequency of On-the-Job Reading Tasks

	NEVER	1-11 TIMES A YEAR	1 TIME EACH MONTH	2-3 TIMES A MONTH	1 or > TIMES A WEEK	DAILY	NO RESPONSE
Trade Manuals	108	86	41	59	91	8	8
Text Books	75	51	45	31	184	12	8
Regulation Books	27	54	40	74	171	28	7
Manufacturer's Instruction Sheets	72	73	64	69	75	35	13
Manufacturer's Instruction Labels	63	75	53	63	94	39	14
Written Instructions From People	58	67	43	62	80	80	11
Microfiche (Eg. Price Lists)	253	50	27	26	19	14	12
Drawings / Sketches	20	42	42	63	108	117	9
Electrical Wiring / Circuit Diagrams	10	31	20	64	127	144	5
Plans / Blueprints	44	45	38	61	95	111	7
Flow Charts	244	68	28	24	16	7	14
Invoices	184	51	39	28	52	37	10
Quotes	259	55	21	25	23	9	9
Price Lists / Part Numbers	124	72	40	51	58	44	12
Job Sheets	91	40	19	30	71	141	9
Computer Screens	253	55	23	28	16	15	11
Street Directory	108	71	42	56	72	47	5
Telephone Book	98	92	47	79	60	18	7
Posters	100	77	41	41	64	71	7
Warnings	33	32	31	64	85	150	6

The results indicated that the apprentices were reading a wide range of non-prose material, particularly warnings, electrical wiring/circuit diagrams and job sheets. The high figure for "text books" was queried and thought to be due to a general confusion of the use of text books in job related courses of study. Other print materials such as microfiche and computers which often have passages of prose, were among the less frequently used on-the-job reading skills.

The print format of the most frequent reading tasks would be ideally suited to skimming and scanning skills where the reader is searching rapidly for the organizational structure of the material and specific items of information. This applies particularly to tasks such as warnings (highest rating), electrical drawings/circuit diagrams (second highest rating), job sheets, drawing/sketches and plans/blue prints.

The second research question in the study asked:

What do the electrical mechanic apprentices think would be the consequences of them not understanding an on-the-job reading task?

The apprentices were once again allowed to give more than one response to the list of consequences and the results to this question are outlined in **Table 3.**

Table 3. The Consequences of On-the-Job Reading Errors

Consequences	Responses
No Problem	50
Time Wasted	311
Job Done Again	233
Material Wasted	232
People Inconvenienced	225
Equipment Damaged	166
Injury	192

The majority of apprentices indicated that on-the-job reading errors would result in time being wasted. Other very likely consequences would include, the job having to be done again, material being wasted and people being inconvenienced.

The dangers to people or equipment through errors in reading were not cited as frequently and the apprentices showed a responsible attitude by rating the "no problem" category as highly unlikely.

The final section of the questionnaire asked the apprentices to comment on other aspects of on-the-job reading that had not been included but no additional items were suggested.

Discussion

The study revealed that although the apprentices indicated they were involved with a wide variety of reading tasks, they generally felt that they did not have to do a great deal of lengthy reading on the job. This was probably because the time taken to read materials was regarded as non-productive and it was seen to be more economical if the persons in charge gave verbal instructions to the apprentices concerned. The main types of on-the-job reading tasks that apprentices did feel were important, appeared to involve skimming and scanning skills used to locate information quickly and the analysis of graphical materials rather than the traditional reading of passages of prose.

The apprentices stated that the consequences of making a reading error on-the-job were important to job efficiency, that is, "time and material were wasted", "job had to be done again" and people were inconvenienced". The data showed that reading accuracy on-the-job was important but not critical, that is people were not injured and equipment was not damaged. However, in most cases there was always a consequence of making a reading error.

Implications

The results of the preliminary stage of the survey into the on-the-job literacy (reading) needs of apprentices has implications for the types of reading experiences that they are given in their trade courses at the various training institutions.

The research suggests that a better balance between basic reading skills and the specialized reading skills of skimming and scanning needs to be established. This would enable much faster and accurate processing of summary forms of information such as warnings, electrical wiring/circuit diagrams, job sheets, drawings and plans/blueprints. Greater emphasis should also be placed on developing visual literacy skills especially in regard to graphics and other non-print material including signs and symbols which provide the necessary links between the abstract diagrams and on-the-job materials and work situations.

Further analysis needs to be made of the data to determine whether there are basic differences in the reading needs of the first, second and third year of apprenticeship and if apprentices in the country have the same needs as those in the metropolitan area.

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